

THE SUBALPINE AND ALPINE VASCULAR FLORA OF THE NEOTA
WILDERNESS AREA IN THE NORTHERN NEVER SUMMER RANGE OF
NORTH-CENTRAL COLORADO

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ABSTRACT

The vascular flora of the Neota Wilderness Area in the northern Never Summer Range of Colorado was inventoried during 1992 and 1993. Approximately 40 km², the area contained both subalpine and alpine vegetation. A subalpine/alpine flora of 54 families, 169 genera, and 301 species, with a predominately boreal-montane, western North American distribution is documented. An alpine flora of 39 families, 118 genera, and 203 species, with a predominately alpine, western North American distribution is reported. *Subularia aquatica* L. is reported as a new record for the state flora of Colorado.

KEY WORDS: Neota Wilderness, flora, Colorado, subalpine, alpine, phytogeography, *Subularia aquatica*

INTRODUCTION

The Neota Wilderness is located in the southern Rocky Mountains in north-central Colorado between Cameron Pass and the northwest boundary of Rocky Mountain National Park. It is a relatively small wilderness area, only 40 km² (USDA Forest Service 1984), and was designated wilderness status in 1980 as part of the Colorado Wilderness Act. It is located at approximately 40° 32' N latitude and 105° 50' W longitude.

Wilderness areas in Colorado have received little floristic attention from investigators as most floristic work has been focused on entire mountain ranges or regions of the state (Hartman & Rottman 1985a, 1985b, 1985c, 1987, 1988; Vanderhorst 1992; Kastning 1990; Weber 1976, 1987, 1990). Two wilderness areas which have been floristically studied in recent years are the Indian Peaks Wilderness

(Komarkova 1979) and the Eagles Nest Wilderness Area (Hogan 1992). Except for these studies, little specific floristic information has been collected for each wilderness area.

This study was conducted during the summers of 1992 and 1993 to inventory and provide a checklist of the subalpine and alpine vascular flora of the Neota Wilderness. Additional objectives included floristic and phytogeographic comparisons of the Neota Wilderness flora with that of other subalpine and alpine floras in Colorado (Nelson 1993).

SITE

Geology. The dominating topographic feature of the Neota Wilderness is Iron Mountain (3738 m), the summit of which lies just outside the western boundary of the wilderness. Three major ridges extend from the summit of Iron Mountain to the north and north-east and form most of the high alpine zone as well as the box canyons in the subalpine zone. Several small subparallel streams drain the area through steepwalled, glaciated valleys and flow generally east-northeast into tributary streams to the Cache La Poudre River. The ridges that separate the streams are generally flat-topped and slope gently to the northeast. Elevations within the wilderness range from approximately 3019 m near the northern boundary to 3667 m near the summit of Iron Mountain. Other peaks within the wilderness include Flattop Mountain (3461 m), Mount Neota (3577 m), Thunder Mountain (3672 m), and Bald Mountain (3292 m).

The Neota Wilderness is underlain by the Precambrian core (schists and gneisses) of the Front Range of Colorado (Pearson 1981). The Precambrian bedrock however, is only exposed in the southeastern and western edges of the wilderness (Corbett 1966). The alpine regions in the wilderness are underlain by volcanic rhyolite. Some 28 million years ago, Specimen Mountain to the southeast and Mount Lulu to the southwest erupted violently sending ash flows and pyroclastic ash falls over the area where the present day wilderness occurs (Corbett 1966, 1968). Today the volcanic material lies directly on top of the Precambrian basement rock and in places is up to 305 m thick (Pearson 1981).

Alpine glaciation during the Pleistocene carved the typical steep-walled, U-shaped valleys and formed the associated glacial deposits found in the Neota Creek and Corral Creek valleys. Altiplanation has produced many relatively rounded ridgetops and upper slopes with numerous soil polygons, rock stripes and rock streams, and hummocky, psuedo-mudflow surfaces which are the result of frost action and solifluction (Corbett 1966; Zwinger & Willard 1972).

Climate. The climate along the Front Range Continental Divide of Colorado is controlled by its mid-latitude continental location and its elevational and topographic situation (Greenland 1989). Based on data from the Joe Wright Reservoir snotel weather station, located on the northern-western boundary of the wilderness near Cameron Pass, the greatest amount of precipitation is received in the months of January, March, and April, with precipitation amounts averaging 125 mm, 122 mm, and 135 mm, respectively (Gillespie 1993). Records indicate that the driest months

are June and August, which average approximately 60 mm of precipitation each (Gillespie 1993). Average temperatures vary from approximately -10° C in December and January to 8–9° C in July and August (Gillespie 1993).

Vegetation. The Neota Wilderness is characterized by subalpine and alpine vegetation. The physiognomic communities in the subalpine of the Neota Wilderness include the spruce-fir forest, wet meadow/marsh, dry meadow, willow thicket, bogs, riparian area, lakes, and rock outcrop/talus/ boulder field sites.

The subalpine forests in the Neota Wilderness are composed primarily of *Picea engelmannii* (Parry) Engelmann and *Abies lasiocarpa* (Hooker) Nuttall. Throughout the subalpine however, occasional stands of *Pinus contorta* Douglas subsp. *latifolia* (Engelmann) Critchfield, *Populus tremuloides* Michaux, and *Pinus flexilis* James can also be found. Large areas of *Pinus contorta* are found along the northern edge of the wilderness between Joe Wright Reservoir and Bald Mountain. In these areas, as well as in some others, evidence of fire was found in the form of fallen charred trees and charcoal.

Beneath the canopy of these forests different types of ground cover exist depending on light and moisture conditions. In the drier portions of the forest, *Vaccinium scoparium* Leiberg forms the predominant ground cover with other common species including *Juniperus communis* L. subsp. *alpina* (Smith) Celakovsky, *Arnica cordifolia* Hooker, and *Packera* spp. Where moister/lower light conditions predominate, *V. scoparium* is less common and species of *Mitella*, *Ranunculus*, *Erigeron*, *Moneses*, and *Listera* are common. As more light is available grasses also become more common.

Subalpine meadows are common in the Corral Creek and Neota Creek valleys. The wet meadow/marsh communities remain wet with water flowing across them throughout most of the summer. Occasionally in late August or September portions of these areas may dry up, but generally they remain wet. Small hummocks occur, commonly topped with moss. Common species found include *Psychrophila leptosepala* (de Candolle) Weber, *Pedicularis groenlandica* Retzius, *Swertia perennis* L., *Carex aquatilis* Wahlenberg, *Gentianella acuta* (Michaux) Hiitonen, *Carex raynoldsii* Dewey, and *Eleocharis* spp.

The dry meadows in the subalpine tend to be slightly more elevated than the wet meadows with less moisture due to better drainage. They are open areas with little or no shade. Common species include *Calamagrostis canadensis* (Michaux) P. Beauvois, *Carex albostriata* Mack., *Carex arapahoensis* Clokey, *Carex foenea* Willd., *Gentianella acuta*, *Ameroselnum lanceolata* (Torr.) Löve & Löve, *Erigeron* spp., *Valeriana edulis* Nutt., and *Juncus drummondii* Meyer.

Often associated with the wet meadow/marsh, although located closer to the forest edge or along the creeks on the valley floor, are dense willow thickets or catts. These areas remain wet and muddy until August when they start to dry up. Common species here are *Salix planifolia* Pursh, *Salix brachycarpa* Nutt., *Betula glandulosa* Michaux, *Aconitum columbianum* Nutt., *Delphinium barbeyi* (Huth) Huth, *Castilleja sulphurea* Rydberg, and *Gentianopsis thermalis* (Kuntze) Iltis.

Subalpine bogs are open or shaded areas where seeps or underground water flows keep them constantly wet. They differ from the wet meadow/marshes by having large hummocks of *Sphagnum* moss. Common bog species include *Trollius albiflorus* (A. Gray) Rydberg, *Gentianopsis thermalis*, *Spiranthes romanzoffiana* Cham. & Schl., and *Salix planifolia*.

Rock outcrop/talus/boulder field communities often have little soil development except in small pockets in crevices and between rocks. Vegetation is often sparse and a variety of lichens cover the rocks. Common vascular plant species found in these locales include *Aquilegia coerulea* James, *Cystopteris fragilis* (L.) Bernhardi, *Luzula spicata* (L.) de Candolle, *Vaccinium scoparium*, and *Castilleja rhexifolia* Rydberg.

Riparian areas in the subalpine include both forested and unforested areas. The unforested riparian communities have been previously described as the wet meadow/marshes, willow thickets, and bogs. Common species along the forested streams include *Mertensia ciliata* (James) G. Don, *Micranthes odontoloma* (Piper) Weber, *Primula parryi* A. Gray, *Senecio triangularis* Hooker, *Cardamine cordifolia* A. Gray, and *Epilobium anagallidifolium* Lamarck.

Subalpine lakes are surrounded by woods and are generally fairly shallow with muddy or gravel bottoms. Within the lakes *Isoetes bolanderi* Engelmann, *Subularia aquatica* L., *Callitricha verna* L., and *Sparganium angustifolium* Michaux occur.

Alpine communities in the Neota Wilderness include wet, moist, and dry meadows, fellfields, krummholz, snowbank, willow thicket, boulder field, talus/cliff, and rivulet communities. Wet meadows occur in areas where seeps or continual water flows from melting snowfields above them. Common wet meadow species include *Psychrophila leptosepala*, *Pedicularis groenlandica*, *Clementsia rhodantha* (A. Gray) Rose, *Carex aquatilis* subsp. *stans* (Drejer) Hulten, and *Carex scopolorum* Holm.

Moist meadows have snow cover until mid summer. Commonly *Sibbaldia procumbens* L., *Erigeron melanocephalus* Nelson, *Salix arctica* Pallas subsp. *petraea* Anderson, *Salix reticulata* L. subsp. *nivalis* (Hooker) Löve et al., *Juncus drummondii*, *Gentianoides algida* (Pallas) Löve & Löve, *Anemonastrum narcissiflorum* (L.) Holub subsp. *zephyrum* (Nelson) Weber, *Micranthes rhomboidea* (Greene) Small, and *Veronica nutans* Bongard occur.

Dry meadows are located near the tops of leeward slopes where snow melts off quickly at the beginning of the summer. Except for occasional summer rains, these meadows receive little additional moisture the rest of the summer. Common species are *Acomastylis rossii* (R. Brown) Greene subsp. *turbinata* (Rydberg) Weber, *Rydbergia grandiflora* (Torrey & Gray) Greene, *Polemonium viscosum* Nutt., *Trifolium dasycyphllum* Torrey & Gray, *Campanula rotundifolia* L., *Gentianella acuta*, *Poa arctica* R. Brown, *Carex chalciolepis* Holm, *Carex elynoides* Holm, *Carex rupestris* Allioni subsp. *drummondii* (Dewey) Holub, and *Trisetum spicatum* (L.) Richter subsp. *congdonii* (Scribner & Merrill) Hulten.

Fellfield communities are commonly found above treeline. These are windswept, rocky expanses on windward sides of slopes where most of the snow is blown off during the winter. As a result they tend to be dry throughout the summer. Common species of the fellfields in the Neota Wilderness include *Erigeron compositus* Pursh,

Mertensia lanceolata (Pursh) de Candolle, *Erysimum capitatum* (Douglas) Greene, *Potentilla uniflora* Ledebour, *Eritrichium aretioides* (Chamisso) de Candolle, *Dryas octopetala* L. subsp. *hookeriana* (Juzepczuk) Hulten, *Paronychia pulvinata* A. Gray, *Silene acaulis* L. subsp. *subcaulescens* (Williams) Hitchcock & Maguire, *Carex rupestris* subsp. *drummondii*, *Castilleja puberula* Rydberg, *Poa arctica*, *Poa glauca* Vahl, *Oreoxis alpina* (A. Gray) Coulter & Rose subsp. *puberulenta* Weber, *Festuca brachyphylla* Schultes subsp. *coloradoensis* Fredriksen, *Trifolium nanum* Torrey, and *C. albonigra*. Fellfields associated with slopes having solifluction terracing are dominated by large mats of *D. octopetala* subsp. *hookeriana*, along with *Acomastylis rossii* subsp. *turbinata*, *Salix arctica* subsp. *petraea*, *S. reticulata* subsp. *nivalis*, and *Castilleja* spp.

Krummholz is transitional between the treeline and the alpine tundra. Trees are twisted, contorted, and flagged by the wind and often only a meter or two in height. Common species in the krummholz include *Pinus engelmannii*, *Abies lasiocarpa*, *Polemonium pulcherrimum* Hooker subsp. *delicatum* (Rydberg) Brand, *Castilleja rhexifolia*, *Juncus drummondii*, *Vaccinium scoparium*, and *Arnica cordifolia*.

In snow bank communities the growing season is very short. Often covered with snow until late in the summer, little grows in these areas. Common plants are *Ranunculus adoneus* A. Gray, *Sibbaldia procumbens*, *Vaccinium scoparium*, and a few mosses.

Alpine willow thickets are few in number and not extensive. They are located in depression areas, near the wet meadows, and below large snowfields. *Salix planifolia*, *S. brachycarpa*, *Noccaea montanum* (L.) Meyer, and *Gentianella acuta*, and in a few locations *Distegia involucrata* (Banks) Cockerell, *Aconitum columbianum*, and *Delphinium barbeyi* are common.

Boulder fields are frequent throughout the alpine. *Ciliaria austromontana* (Weigand) Weber, *Ribes cereum* Douglas, *Rubus idaeus* L. subsp. *melanolasius* (Dicke) Focke var. *aculeatissimus* Regel & Tiling, *Erigeron leiomerus* A. Gray, *Aquilegia coerulea*, *Heuchera parviflora* Nutt. and a variety of different lichen species are scattered among the boulders.

The talus slopes and cliff areas occur regularly above treeline. *Ligularia soldanella* (A. Gray) Weber, *Ligularia holmii* (Greene) Weber, *Aquilegia coerulea*, *Saxifraga rivularis* L., *Heuchera parviflora*, *Festuca brachyphylla* subsp. *coloradoensis*, *Luzula spicata*, *Carex crandallii* Gandoger, *Castilleja rhexifolia*, and a number of different lichens are common on these unstable slopes.

Along the infrequent alpine rivulets *Psychrophila leptosepala*, *Carex aquatilis* subsp. *stans*, *Epilobium anagallidifolium*, and *Clementsia rhodantha* dominate.

FLORISTICS AND PHYTOGEOGRAPHY

Flora. The vascular flora of the Neota Wilderness was inventoried during the summers of 1992 and 1993. Identifications were verified at the University of

Northern Colorado Herbarium (GREE) and the University of Colorado Herbarium (COLO). The flora is characterized in two ways to better facilitate comparisons with other studies. The first method examines the flora of the wilderness in its entirety, incorporating species found in both the subalpine and alpine life zones. It is designated as the subalpine/alpine flora. The second method focuses on only the alpine flora.

Subalpine/Alpine Flora. A subalpine/alpine vascular flora representing 54 families, 169 genera, and 301 species of plants is found in the Neota Wilderness. The plant families contributing the greatest number of species to the flora are: Asteraceae (40 species), Poaceae (31 species), Cyperaceae (27 species), Brassicaceae (18 species), Rosaceae (16 species), Scrophulariaceae (16 species), and Saxifragaceae (14 species). Seven species endemic to Colorado/Southern Rocky Mountains occur, based on Weber & Wittman (1992). They are *Paronychia pulvinata*, *Oreoxis alpina* subsp. *puberulenta*, *Ligularia holmii*, *L. soldanella*, *Ligularia taraxacoides* (A. Gray) Weber, *Aquilegia saximontana* Rydberg, and *Primula angustifolia* Torrey.

Subularia aquatica was found growing on the muddy bottom of a subalpine lake and was reported as a new record for the state flora of Colorado (Nelson & Harmon 1993). Its discovery in Colorado extends its range southward, from known locations in Wyoming, by approximately 435–450 km, and its range eastward from a location in Utah by approximately 354 km (Nelson & Harmon 1993; Mulligan & Calder 1964).

A range extension is also reported for *Azaleastrum albiflorum* (Hooker) Rydberg. The discovery of this shrub in the Neota Wilderness represents the first discovery of *A. albiflorum* in Larimer Co., Colorado, and an extension of its range by 40–64 km east-southeast from its previously known localities in the Park Range.

No threatened or endangered species were found in the Neota Wilderness. However, ten Species of Special Concern listed by the Colorado Natural Heritage Program were found (CNHP 1996). These include *Aquilegia saximontana*, *Castilleja puberula*, *Chionophila jamesii* Benth., *Draba crassa* Rydberg, *Draba fladnizensis* Wulfen, *Draba lonchocarpa* Rydberg, *Draba streptobrachia* Price, *Azaleastrum albiflorum*, *Muscaria monticola* Small, and *Subularia aquatica*.

Alpine Flora. The alpine vascular flora represents 39 families, 118 genera, and 203 species in the Neota Wilderness. The plant families contributing the greatest number of species to the alpine flora are: Asteraceae (37 species), Cyperaceae (15 species), Poaceae (14 species), Brassicaceae (13 species), Scrophulariaceae (12 species), Rosaceae (12 species), and Saxifragaceae (12 species). The same seven species mentioned above in the Subalpine/Alpine Flora section as endemic to Colorado/Southern Rocky Mountains occur in the alpine flora of the Neota Wilderness. No threatened or endangered species have been found in the alpine flora; however, the same State Species of Special Concern mentioned above in the Subalpine/Alpine Flora section apply here, with the exception of *Azaleastrum albiflorum* and *Subularia aquatica* which were found only in the subalpine.

Floristic Comparisons. Floristic comparisons between the subalpine/alpine and alpine Neota Wilderness floras and other floras in Colorado use the Sorenson coefficient of similarity (Mueller-Dombois & Ellenberg 1974; Hogan 1992). The

Sorensen coefficient is an index equal to $[(2C/A+B) \times 100]$ where C equals the number of species shared by both sites, and A and B are the total number of species from each respective site.

Floristic comparisons were made using the Sorensen index value between the subalpine/alpine Neota Wilderness flora and the subalpine/alpine floras of the Eagles Nest Wilderness (60.5%; Hogan 1992), Needles Mountains (59.3%, Michner 1964) and Robinson Basin (53.6%, Bathke 1968). Floristic comparisons were also made between the alpine Neota flora and the alpine floras of the Indian Peaks Wilderness area (68.28%, Komarkova 1979), Sawatch Range (68.02%; Hartman & Rottman 1988), Ruby Range (67.30%; Hartman & Rottman 1987), Mt. Bross (58.86%; Hartman & Rottman 1985a), San Juan Mountains (64.66%; Hartman & Rottman 1985b), and Specimen Mountain (64.92%; McNeal 1976). These comparisons show the subalpine/alpine flora and alpine flora of the Neota Wilderness to have a relatively high similarity (54-68%) with the floras of other mountain ranges in Colorado. This agrees with the findings of Hartman & Rottman (1988), who indicated that most of the differences that exist between alpine floras in Colorado can be attributed to distributional ranges of taxa or substrate and microhabitat differences.

Phytogeography. The flora of the Neota Wilderness can be characterized phytogeographically using flora element and geographic subelement categories. This follows the method described and used by Komarkova (1979) and used by other researchers in Colorado in recent years (Hartman & Rottman 1985a, 1985b, 1987, 1988; Hogan 1992). Floristic elements represent both the latitudinal (arctic, boreal) and altitudinal (alpine, montane) distribution of the taxa. The geographic subelement denotes the geographic range of the taxa, beginning with the broadest distribution (circumpolar) and ending with the most restricted (Colorado).

The phytogeographic distribution of the subalpine/alpine flora (Table 1) reveals that the largest floristic element in the Neota Wilderness flora is the Boreal-Montane element (32.6%). The Arctic-Alpine element (20.3%) is the lowest percentage. Phytogeographic subelement distribution of the subalpine/alpine flora (Table 1) shows that the largest geographic subelement in the Neota Wilderness flora is the Western North America subelement (32.6%) followed by the Circumpolar subelement (22.3%). The lowest percentage of the flora is made up of the North American-European subelement (1.0%).

The phytogeographic distribution of the alpine flora of the Neota Wilderness reveals that the largest flora element is the Alpine element (34.5%) (Table 2). The lowest percentage of the alpine flora is composed of the Montane element (15.8%). The phytogeographic subelement distribution of the alpine flora (Table 2) shows that the Western North American subelement comprises the largest percentage of the alpine flora (33.0%) followed by the Circumpolar subelement (19.7%). The lowest percentage of the alpine flora is from the North American-European subelement (0.5%).

A comparison of the subalpine/alpine and alpine flora elements in the Neota flora reveals that in both cases approximately 50% of the flora have a strong tie to the boreal and arctic floras found at higher latitudes. It is also apparent that as the base elevation of a site decreases (adding the subalpine flora to the alpine flora), the percentage of

Alpine and Arctic-Alpine species decreases and an increase in the percentage of Montane and Boreal-Montane element species occurs. A similar comparison of the subelement data shows that the Neota flora is composed of primarily Western North American and Circumpolar subelement species. The high percentage of North American-Asiatic species as compared to North American-European species underscores the floristic relationship that exists between the Rocky Mountains and Asiatic mountains. This has been discussed by others (Weber 1965, 1987; Komarkova 1979). These generalizations are accurate for the subalpine/alpine and alpine floras across the state when different floristic studies have been compared across Colorado (Nelson 1993).

Table 1. Phytogeographic distribution of subalpine/alpine flora of the Neota Wilderness.

Phytogeographic Category	# Species	Percent
Element		
Arctic-Alpine (AA)	61	20.3
Alpine (A)	80	26.6
Boreal-Montane (BM)	98	32.6
Montane (M)	62	20.5
Subelement		
Circumpolar (C)	67	22.3
North American (NA)	37	12.3
Western North American (WNA)	98	32.6
Rocky Mountain (RM)	38	12.6
Southern Rocky Mountains (SRM)	26	8.6
Colorado (CO)	5	1.7
North American-Asiatic (NAA)	27	9.0
North American-European (NAE)	3	1.0

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Table 2. Phytogeographic distribution of the alpine flora of the Neota Wilderness.

Phytogeographic Category	# Species	Percent
Element		
Arctic-Alpine (AA)	51	25.1
Alpine (A)	70	34.5
Boreal-Montane (BM)	50	24.6
Montane (M)	32	15.8
Subelement		
Circumpolar (C)	40	19.7
North American (NA)	21	10.3
Western North American (WNA)	67	33.0
Rocky Mountains (RM)	27	13.3
Southern Rocky Mountains (SRM)	23	11.3
Colorado (CO)	5	2.5
North American-Asiatic (NAA)	19	9.4
North American-European (NAE)	1	0.5

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NEOTA WILDERNESS SPECIES LIST

Nomenclature follows that given in Weber & Wittman (1992). A complete voucher collection of the flora is located in the herbarium at the University of Northern

Colorado (GREE). In addition, duplicates of some specimens are also found in the University of Colorado - Boulder herbarium (COLO). As with all floras, this is a working flora and although pains were taken to explore all the habitats found in the area a number of times throughout the two summers, it is still possible that some plants may have been missed. This study provides a baseline of floristic data for the wilderness to which additions may be made. Phytogeographic codes follow those presented in Tables 1 and 2. The letter (E) preceding some species indicates an endemic species.

CATALOGUE OF VASCULAR PLANT TAXA OF THE NEOTA WILDERNESS, COLORADO

MICROPHYLLPHYTA

Isoetaceae

Isoetes bolanderi Engelmann - BM, WNA

Lycopodiaceae

Lycopodium annotinum L. - BM, C

Selaginellaceae

Selaginella densa Rydberg - A, WNA

SPHENOPHYTA (ARTHROPHYTA)

Equisetaceae

Equisetum arvense L. - BM, C

PTERIDOPHYTA

Athyriaceae

Cystopteris fragilis (L.) Bernhardi - AA, C

Cryptogrammaceae

Cryptogramma acrostichoides R. Brown - BM, NAA

Woodsiaceae

Woodsia scopulina D.C. Eaton - BM, NA

CONIFERO PHYTA

Cupressaceae

Juniperus communis L. subsp. *alpina* (Smith) Celakovsky - BM, C

Pinaceae

Abies lasiocarpa (Hooker) Nuttall - BM, WNA; *Picea engelmannii* (Parry) Engelmann - BM, WNA; *Pinus contorta* Douglas subsp. *latifolia* (Engelmann) Critchfield - BM, WNA; *Pinus flexilis* James - BM, WNA

ANTHOPHYTA-DICOTYLEDONEAE (DICOTS)

Adoxaceae

Adoxa moschatellina L. - BM, C

Alsinaceae

Cerastium beeringianum Chamisso & Schlechtendal subsp. *earlei* (Rydberg) Hulten - A, RM; *Cerastium stricta* L. emend Haenke - BM, C; *Eremogone fendleri* (A. Gray) Ikonnikov - A, SRM; *Lidia obtusiloba* (Rydberg) Löve & Löve - AA,

NAA; (E) *Paronychia pulvinata* A. Gray - A, SRM; *Sagina saginoides* (L.) Karstens - AA, C; *Stellaria longipes* Goldie - BM, NA; *Stellaria umbellata* Turczaninow - A, NAA; *Tryphane rubella* (Wahlenburg) Reichenbach - AA, C

Apiaceae

Angelica grayi (Coulter & Rose) Coulter & Rose - A, SRM; *Ligusticum porteri* Coulter & Rose - M, WNA; (E) *Oreoxis alpina* (A. Gray) Coulter & Rose subsp. *puberulenta* Weber - A, CO; *Oreoxis alpina* (A. Gray) Coulter & Rose - A, SRM; *Osmorhiza depauperata* Phillippi - M, NA; *Oxypolis fendleri* (A. Gray) Heller - M, SRM; *Pseudocymopteris montanus* (A. Gray) Coulter & Rose - M, SRM

Asteraceae

Achillea lanulosa Nuttall - M, WNA; *Agoseris aurantiaca* (Hooker) Greene - BM, WNA; *Agoseris glauca* (Pursh) Rafinesque - BM, NA; *Anaphalis margaritacea* (L.) Bentham & Hooker - BM NAA; *Antennaria corymbosa* Nelson - M, WNA; *Antennaria media* Greene - AA, WNA; *Antennaria rosea* Greene - BM, WNA; *Antennaria umbrinella* Rydberg - A, WNA; *Arnica cordifolia* Hooker - BM, WNA; *Arnica mollis* Hooker - BM, NA; *Arnica rydbergii* Greene - BM, WNA; *Artemisia arctica* Lessing subsp. *saxicola* (Rydberg) Hulten - AA, NAA; *Artemisia michauxiana* Besser - BM, WNA; *Artemisia scopulorum* A. Gray - A, RM; *Aster foliaceus* Lindley - M, WNA; *Chlorocrepis tristis* (Willdenow) Löve & Löve subsp. *gracilis* (Hooker) Weber - M, WNA; *Cirsium centaureae* (Rydberg) Schwann - M, RM; *Cirsium tweedyi* (Rydberg) Petrak - A, RM; *Erigeron compositus* Pursh - BM NA; *Erigeron elatior* (A. Gray) Greene - M, SRM; *Erigeron leiomerus* A. Gray - M, RM; *Erigeron melanocephalus* Nelson - A, SRM; *Erigeron peregrinus* (Banks) Greene subsp. *callianthemus* (Greene) Cronquist - A, SRM; *Erigeron pinnatisectus* (A. Gray) Nelson - A, SRM; *Erigeron simplex* Greene - A, WNA; *Heterotheca pumila* (Greene) Semple - M, RM; (E) *Ligularia holmii* (Greene) Weber - A, RM; (E) *Ligularia soldanellea* (A. Gray) Weber - A, CO; (E) *Ligularia taraxacoides* (A. Gray) Weber - A, SRM; *Packera dimorphophylla* (Greene) Weber & Löve - A, RM; *Packera wernyiifolia* (A. Gray) Weber & Löve - A, RM; *Rydbergia grandiflora* (Torrey & Gray) Greene - A, RM; *Senecio atratus* Greene - M, SRM; *Senecio crassulus* A. Gray - M, WNA; *Senecio fremontii* Torrey & Gray var. *blitoides* (Greene) Cronquist - A, WNA; *Senecio triangularis* Hooker - BM, WNA; *Solidago multiradiata* Aiton subsp. *scopulorum* (A. Gray) Weber - BM, WNA; *Taraxacum officinale* H.G. Weber - BM, C; *Taraxacum ovinum* Rydberg - AA, C; *Tonestus pygmaeus* (Torrey & Gray) Nelson - A, RM

Betulaceae

Betula glandulosa Michaux - BM NA

Boraginaceae

Eritrichium aretioides (Chamisso) de Candolle - AA, NAA; *Mertensia ciliata* (James) G. Don - M, WNA; *Mertensia lanceolata* (Pursh) de Candolle - A, WNA

Brassicaceae

Boechera drummondii (A. Gray) Löve & Löve - BM, NA; *Cardamine cordifolia* A. Gray - M, WNA; *Cardamine pennsylvanica* Muhlenberg - BM, NA; *Draba albertina* Greene - AA, NAE; *Draba aurea* Vahl. - AA, WNA; *Draba cana* Rydberg - AA, C; *Draba crassa* Rydberg - A, RM; *Draba crassifolia* Graham - AA, NAE; *Draba fladnizensis* Wulfen - AA, C; *Draba lonchocarpa* Rydberg - A, NAA; *Draba nemorosa* L. - BM, C; *Draba streptobrachia* Price - A, CO; +*Draba streptocarpa* A. Gray - A, SRM; *Erysimum capitatum* (Douglas) Greene - A, WNA; *Noccaea montana* (L.) Meyer - M, WNA; *Roripa curvipes* Greene var. *alpina* (Watson)

Stuckey - A, RM; *Smelowskia calycina* (Stephans) Meyer - AA, NAA; *Subularia aquatica* L. - BM, C

Callitrichaceae

Callitricha verna L. - BM, C

Campanulaceae

Campanula rotundifolia L. - BM, C; *Campanula uniflora* L. - AA, C

Caprifoliaceae

Distegia involucrata (Banks) Cockerell - BM, NA; *Sambucus microbotrys* Rydberg - BM, NA

Caryophyllaceae

Gastrolychnis drummondii (Hooker) Löve & Löve - BM, Nal; *Gastrolychnis kingii* (Watson) Weber - A, SRM; *Silene acaulis* L. subsp. *subcaulescens* (Williams) Hitchcock & Maguire - AA, NAA

Crassulaceae

Amerosedum lanceolatum (Torrey) Löve & Löve - A, WNA; *Clementsia rhodantha* (A. Gray) Rose - A, RM; *Rhodiola integrifolia* Rafinesque - AA, NAA

Ericaceae

Arctostaphylos uva-ursi (L.) Sprengel - BM, C; *Azaleastrum albiflorum* (Hooker) Rydberg - M, WNA; *Gaultheria humifusa* (Graham) Rydberg - BM, WNA; *Kalmia microphylla* (Hooker) Heller - BM, WNA; *Vaccinium caespitosum* Michaux - BM, NA; *Vaccinium scoparium* Leiberg - BM, WNA

Fabaceae

Trifolium dasypodium Torrey & Gray - A, RM; *Trifolium nanum* Torrey - A, RM; *Trifolium parryi* A. Gray - A, RM; *Vicia americana* Muhlenberg - BM, NA

Gentianaceae

Chondrophylla prostrata (Haenke) J.P. Anderson - AA, C; *Comastoma tenellum* (Rottboell) Toyokuni - AA, C; *Gentianella acuta* (Michaux) Hiitonem - BM, NAA; *Gentianoides algida* (Pallas) Löve & Löve - AA, NAA; *Gentianopsis barbellata* (Engelmann) Iltis - A, SRM; *Gentianopsis thermalis* (Kuntze) Iltis - A, RM; *Pneumonanthe parryi* (Engelmann) Greene - M, RM; *Swertia perennis* L. - A, C

Geraniaceae

Geranium richardsonii Fisher & Trautvetter - M, WNA

Grossulariaceae

Ribes cereum Douglas - M, WNA; *Ribes coloradoense* Coville - M, SRM; *Ribes montigenum* McClatchie - M, WNA

Helleboraceae

Aconitum columbianum Nuttall - BM, WNA; *Aquilegia coerulea* James - M, RM; *Aquilegia saximontana* Rydberg - A, CO; *Delphinium barbeyi* (Huth) Huth. - M, SRM; *Psychrophila leptosepala* (de Candolle) Weber - A, WNA; *Trollius albidiflorus* (A. Gray) Rydberg - M, WNA

Hydrophyllaceae

Phacelia sericea (Graham) A. Gray - A, WNA

Monotropaceae

Hypopitys monotropa Crantz - BM, C

Onagraceae

Chamerion daniellii (Daniels) D. Löve - BM, C; *Epilobium anagallidifolium* Lamarck - AA, C; *Epilobium halleanum* Haussknecht - BM, WNA; *Epilobium hornemannii* Reichenbach - BM, C; *Epilobium lactiflorum* Haussknecht - BM, C; *Gayophytum diffusum* Torrey & Gray subsp. *parviflorum* Lewis & Szweykowski - M, WNA

Parnassiaceae

Parnassia fimbriata Banks - BM, WNA

Plantaginaceae

Plantago tweedyi A. Gray - M, RM

Polemoniaceae

Polemonium pulcherrimum Hooker subsp. *delicatum* (Rydberg) Brand - M, NAA;

Polemonium viscosum Nuttall - A, WNA

Polygonaceae

Bistorta bistortoides (Pursh) Small - A, WNA; *Bistorta vivipara* (L.) S. Gray - AA, C; *Eriogonum subalpinum* Greene - M, WNA; *Eriogonum jamesii* Bentham var. *xanthus* (Small) Reveal - M, WNA; *Oxyria digyna* (L.) Hill - AA, C;

Polygonum douglasii Greene - M, WNA; *Rumex densiflorus* Osterhout - M, RM

Portulacaceae

Oreobroma pygmaea (A. Gray) Howell - A, WNA; *Claytonia megarhiza* (A. Gray) Pursh - A, RM

Primulaceae

Androsace septentrionalis L. - A, C; *Dodecatheon pulchellum* (Rafinesque) Merrill - BM, WNA; *Primula angustifolia* Torrey - A, SRM; *Primula parryi* A. Gray - A, RM

Pyrolaceae

Moneses uniflora (L.) S. Gray - BM, C; *Orthilia secunda* (L.) House - BM, NAA; *Pyrola minor* L. - BM, C

Ranunculaceae

Anemonastrum narcissiflorum (L.) Holub subsp. *zephyrum* (Nelson) Weber - A, SRM; *Anemone multifida* Poiret subsp. *globosa* (Nuttall) Torrey & Gray - BM, NA; *Pulsatilla patens* (L.) Miller subsp. *hirsutissima* Zamel - BM, NA; *Ranunculus adoneus* A. Gray - A, RM; *Ranunculus alismifolius* Geyer var. *montanus* Watson - BM, WNA; *Ranunculus eschscholtzii* Schlechtendal - AA, NAA; *Ranunculus gmelinii* de Candolle var. *hookeri* (D. Don) Benson - BM, NAA; *Ranunculus reptans* L. - BM, C

Rosaceae

Acomastylis rossii (R. Brown) Greene subsp. *turbinata* (Rydberg) Weber - AA, NAA; *Amelanchier alnifolia* Nuttall - BM, WNA; *Dryas octopetala* L. subsp. *hookeriana* (Juzepczuk) Hulten - AA, C; *Drymocallis glandulosa* (Lindley) Rydberg - M, WNA; *Erythrocoma triflora* (Pursh) Greene - M, NA; *Fragaria virginiana* Miller subsp. *glaucia* (Watson) Staudt - M, C; *Pentaphylloides floribunda* (Pursh) A. Löve - BM, C; *Potentilla diversifolia* Lehmann - A, WNA; *Potentilla hippiana* Lehmann - M, WNA; *Potentilla ovina* Macoun - M, WNA; *Potentilla pensylvanica* L. - BM, NA; *Potentilla rubricaulis* Lehmann - AA, NA; *Potentilla uniflora* Ledebour - AA, NAA; *Rosa woodsiae* Lindley - BM, NA; *Rubus idaeus* L. subsp. *melanolasius* (Dicke) Focke var. *aculeatissimus* Regel & Tiling - BM, C; *Sibbaldia procumbens* L. - AA, C

Rubiaceae

Galium trifidum (L.) subsp. *brevipes* (Fernald & Wiegand) Löve & Löve - BM, C

Salicaceae

Populus balsamifera L. - BM, NA; *Populus tremuloides* Michaux - BM, NA; *Salix arctica* Pallas subsp. *petraea* Anderson - AA, C; *Salix boothii* Dorn - M, RM; *Salix brachycarpa* Nuttall - BM, NA; *Salix planifolia* Pursh - BM, NA; *Salix reticulata* L. subsp. *nivalis* (Hooker) Löve et al. - A, WNA

Saxifragaceae

Ciliaria austromontana (Weigand) Weber - M, WMA; *Heuchera bracteata* (Torrey) Seringe - A, SRM; *Heuchera parvifolia* Nuttall - M, RM; *Hirculus platysepalus* (Trautvetter) Weber subsp. *crandallii* (Gandoger) Weber - A, SRM; *Hirculus serpylifolius* (Pursh) Weber subsp. *crysanthus* (A. Gray) Weber - AA, NAA; *Micranthes odontoloma* (Piper) Weber - BM, WNA; *Micranthes rhomboidea* (Greene) Small - M, WNA; *Mitella pentandra* Hooker - BM, WNA; *Mitella stauropetala* Piper var. *stenocephala* (Piper) Rosendahl - M, RM; *Muscaria delicatula* Small - AA, C; *Muscaria monticola* Small - AA, C; *Saxifraga cernua* L. - AA, C; *Saxifraga hyperborea* R. Brown subsp. *debilis* (Engelmann) Löve et al. - A, WNA; *Saxifraga rivularis* L. - AA, C

Scrophulariaceae

Besseya alpina (A. Gray) Rydberg - A, SRM; *Castilleja miniata* Douglas - BM, WNA; *Castilleja occidentalis* Torrey - A, RM; *Castilleja puberula* Rydberg - A, CO; *Castilleja rhexifolia* Rydberg - M, RM; *Castilleja sulphurea* Rydberg - M, RM; *Chionophila jamesii* Benthams - A, SRM; *Mimulus guttatus* de Candolle - BM, WNA; *Pedicularis bracteosa* Benthams subsp. *paysoniana* (Pennell) Weber - M, RM; *Pedicularis groenlandica* Retzius - AA, RM; *Pedicularis parryi* A. Gray - A, RM; *Pedicularis racemosa* Douglas subsp. *alba* Pennell - M, WNA; *Penstemon confertus* Douglas subsp. *procerus* (Douglas) Clark - BM, WNA; *Penstemon whippleanus* A. Gray - M, RM; *Veronica americana* (Rafinesque) Schweinitz - BM, NAA; *Veronica nutans* Bongard - AA, WNA

Valerianaceae

Valeriana edulis Nuttall - M, WNA

Violaceae

Viola labradorica Schrank - BM, NA; *Viola renifolia* A. Gray var. *brainerdii* (Greene) Fernald - BM, NA

Viscaceae

Arceuthobium americanum Nuttall - BM, WNA

ANTHOPHYTA-MONOCOTYLEDONEAE (MONOCOTS)

Cyperaceae

Carex albonigra Mack. - AA, WNA; *Carex aquatilis* Wahlenberg - AA, C; *Carex aquatilis* Wahlenberg subsp. *stans* (Drejer) Hulten - AA, C; *Carex arapahoensis* Clokey - A, SRM; *Carex brevipes* Boott - BM, WNA; *Carex buxbaumii* Wahlenberg - BM, NAE; *Carex capillaris* L. - AA, C; *Carex chalciolepis* Holm - A, WNA; *Carex crandallii* Gandoger - A, WNA; *Carex eggelstonii* Mack. - M, SRM; *Carex elynoides* Holm - A, WNA; *Carex foenea* Willdenow - BM, NA; *Carex hoodii* Boott - M, WNA; *Carex illota* Bailey - A, WNA; *Carex jonesii* Bailey - M, WNA; *Carex lachenalii* Schkuhr - AA, C; *Carex nigricans* Meyer - AA, NAA; *Carex parryana* Dewey subsp. *hallii* Murray - BM, NA; *Carex periglobosa* Mack - A, SRM; *Carex praeceptorum* Mack. - A, WNA; *Carex raynoldsii* Dewey - M, WNA; *Carex rupestris* Allioni subsp. *drummondii* (Dewey) Holub - A, WNA; *Carex scopolorum* Holm - A, WNA; *Eleocharis bolanderi* A. Gray - M, WNA; *Eleocharis palustris* (L.) Roemer & Schultes - BM, C; *Eleocharis quinqueflora* (Hartman) Schwartz - BM, C; *Eriophorum angustifolium* Honekeny - AA, C.

Juncaceae

Juncus biglumis L. - AA, C; *Juncus drummondii* Meyer - A, WNA; *Juncus mertensianus* Bongard - A, NAA; *Juncus nevadensis* Watson - M, WNA; *Juncus triglumis* L. - AA, C; *Luzula comosa* E. Meyer - M, NA; *Luzula parviflora* (Erhart) Desvaux - BM, C; *Luzula spicata* (L.) de Candolle - A, RM

Liliaceae

Erythronium grandiflorum Pursh - M, RM; *Lloydia serotina* Reichenbach - AA, C
Melanthiaceae

Anticlea elegans (Pursh) Rydberg - AA, WNA

Orchidaceae

Corallorrhiza maculata Rafinesque - BM, NA; *Corallorrhiza trifida* Chatelain - BM, C; *Goodyera oblongifolia* Rafinesque - BM, NA; *Limnochis dilatata* Rydberg subsp. *albiflora* (Chamisso) Löve & Simon - BM, NA; *Listera cordata* (L.) R. Brown subsp. *nephrophylla* (Rydberg) Löve & Löve - BM, C; *Spiranthes romanzoffiana* Cham. & Schl. - BM, NA

Poaceae

Agrostis humilis Vasey - A, WNA; *Agrostis mertensii* Trinius - AA, C; *Agrostis scabra* Willdenow - BM, NA; *Agrostis variabilis* Rydberg - A, WNA; *Alopecurus aequalis* Sobol - AA, C; *Alopecurus alpinus* Smith - AA, C; *Bromopsis canadensis* (Michaux) Holub - BM, NAA; *Calamagrostis canadensis* (Michaux) P. Beauvois - BM, NAA; *Calamagrostis purpurascens* R. Brown - AA, NAA; *Danthonia intermedia* Vasey - BM, NAA; *Deschampsia caespitosa* (L.) P. Beauvois - BM, C; *Elymus elymoides* (Rafinesque) Swezey - M, WNA; *Elymus scribneri* (Vasey) Jones - A, WNA; *Elymus trachycaulus* (Link) Gould - AA, NA; *Festuca baffinensis* Poulin - AA, NA; *Festuca brachyphylla* Schultes subsp. *coloradoensis* Frederiksen - AA, NAA; *Hierochloe hirta* (Shrank) Borbas subsp. *arctica* (Presl) Weimarck - AA, C; *Koeleria macrantha* (Ledebour) Schultes - M, C; *Phleum commutatum* Gaudin - AA, C; *Poa alpina* L. - AA, C; *Poa arctica* R. Brown - AA, WNA; *Poa cusickii* Vasey subsp. *epilis* (Scribnier) Weber - A, WNA; *Poa glauca* Vahl - A, WNA; *Poa glaucifolia* Scribner & Williams - M, RM; *Poa nemoralis* L. subsp. *interior* (Rydberg) Butter & Abbe - BM, NA; *Poa nervosa* (Hooker) Vasey - M, WNA; *Poa reflexa* Vasey & Scribner - A, WNA; *Poa secunda* Presl. - M, WNA; *Torreyochoa pauciflora* (Presl.) Church - BM, WNA; *Trisetum spicatum* (L.) Richter - AA, C; *Trisetum spicatum* (L.) Richter subsp. *congdonii* (Scribner & Merrill) Hulten - AA, C

Sparganiaceae

Sparganium angustifolium Michaux - AA, C

Uvulariaceae

Streptopus fassettii Löve & Löve - BM, WNA